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THE TECHNIC.

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THE Christmas season is now approaching. Soon the merry shouts of happy children will be heard throughout the land, and all christendom will sing "Christ is born in Bethlehem." How many different thoughts are carried to different minds by this season! There is the Christmas of Scrooge and the Christmas of those who believe that this is the time for "Peace on earth, good will toward men." The pure lovable feelings that take possession of a man at this time forces one to believe that the world is not all bad. It has been written that "a man who is not touched by the Christmas spirit is beyond redemption." This seems rather a hard statement and might be modified into the expression, "He who is not touched by the Christmas spirit misses one of the blessings that go to make life worth living."

ROOT! Who said root? From some cause or other there has been a decided lack of systematic rooting this year. Two years ago at the beginning of the foot-ball season a meeting was called and the Rooters' Club was formed. Various methods were adopted to raise funds to defray the expenses incurred by the sending of some members of the club with the teams on various trips, the purchase of megaphones, buttons, etc. There was system to the whole affair, but it seems this year that there has been an uncalled for dropping off of enthusiasm and not even a yell-master has been elected, consequently the yelling has been intermittent. There are certain times to yell and certain yells which should only be given at certain times. However, several men have been doing good work under the circumstances. But let the leaders of last year's club get together and leave the organization perfected and permanently established, so that each year our men entered in contest will not listen in vain for a stimulating yell or an encouraging song. So let us have a good, strong Rooters' Club by Christmas, trained to such a degree that our basket-ball and base-ball teams may be fully benefited by its efforts.

THE Y. M. C. A. room is at the disposal of all students, to be used either as a study or a reading room. The exchange table of THE ROSE TECHNIC is located there. On it one will find college magazines from all parts of the country, and so can keep posted on the happenings of the college world. Besides these there are all the standard magazines on hand. But

the privileges so kindly extended by the Y. M. C. A. must not be abused. A rough and tumble scraps relished by all men, but the campus is the place for this form of amusement, and not a room hampered by four walls as well as furniture. There are some among the students who apparently have the idea that the exchange table is run solely for their benefit, and accordingly, mutilate the magazines by clipping from them any pictures and anecdotes that please their fancies. This isn't just right as others may wish to see those same pictures. So, please don't do it.

THE foot-ball season ended for the R. P. I. on Thanksgiving day, with a victory over the I. S. N. In spite of prophecies to the contrary, the men have made a successful season. Giving weight in nearly every instance, they have won the majority of games played. Few people realize the work necessary to put out a winning team. Constant practice is an absolute necessity. This meant, in many cases, signal practice in the gym by electric light after tackling and scrimmage practice on the campus. Some of the men were a little slow in responding to the first call, and affairs looked hopeless for a time, but under the resistless energy of Capt. McBride, backed by Manager Lee, a good team was assured. Much credit is due to these two men but much credit is also due to the remainder of the team individually and collectively. The scrubs also did their part and we think that nine rahs for the whole bunch would not be inappropriate.

AS a slight deviation from the usual run of scientific articles appearing in this department, we have the pleasure this month of printing a letter from Mr. G. R. Putnam of the U. S. Coast and Geodetic Survey, who is at present stationed in the Philippines. Mr. Putnam graduated from Rose in the class of 1890.

ON December 24, 1794, Chauncey Rose was born. On the anniversery of his natal day this splendid man's good deeds seem to stand out more distinctly. The minds of the people of Terre Haute do not need freshening, as the monuments of his generosity are constant reminders of his desire to do the most good for the most people. Beginning life as a poor boy, he attained by honesty, industry and integrity a most enviable place among his fellow-men.

OUR attention has been called to a mistake in the Department of Reviews in the November issue. The review of the American Diesel Engine reads. "At three cents per gallon this means 100 h. p. per hour at 2¼ cents, or 100 kilowatts per hour at 3.15 cents." This should read: "At three cents per gallon this means 100 h.p. per hour at 22.5 cents or 100 kilowatts per hour at 31½ cents."

BEGINNING January 9, 1905, examinations will be held at the New York Navy Yards, to fill vacancies in the Civil Engineering Corps, U. S. N. Appointments are made after competative examinations. The pay, on entering, is $1,500, increasing with length of service. Officers in this department, at the age of 62, or if they are disabled in discharge of their duty, are retired on three-fourths full pay. This corps is a growing one and offers a good opening for an ambitious young man. Complete sets of previous examinations can be found in the Engineering News for January 27, 1898, January 19, 1899; May 1, 1902, and August 13, 1903.

The Turbine as a Gas Engine.

By F. C. WAGNER.

THE successful development of the steam turbine has suggested the question as to whether or not the turbine would serve also as a gas engine. A number of experimenters have worked upon the problem, but up to the present time sufficient progress has not been made to render the gas turbine a commercial machine. It is proposed in what follows to consider some of the reasons why the turbine may be expected to be an improvement upon the reciprocating gas engine, and also some of the difficulties involved.

First, it may be instructive to consider the reasons why the steam turbine has come to the front so rapidly.

One of the chief sources of loss in the steam engine is that due to cylinder condensation. With the ordinary simple non-condensing engine, the temperature of the exhaust steam is about 215 degrees Fahrenheit. While the cylinder walls, cylinder head and face of the piston are in contact with the exhaust steam they tend to arrive at this same temperature. When the steam from the boiler at 100 pounds pressure, for instance, and a temperature of 338 degrees Fahrenheit, enters the cylinder at the beginning of the next stroke, the steam comes into contact with surfaces more than 120 degrees colder than itself. The result is that the steam loses a large amount of heat, a part of the steam being condensed into water. The proportion thus condensed varies from 20 to 70 per cent of the total amount of steam, depending upon various conditions, such as the range of temperatures, point of cut-off, etc. It is to overcome this cylinder condensation that compound and triple expansion engines have been developed, which operate to reduce the temperature range in a single cylinder. Superheating the steam also has the prevention of cylinder condensation for its chief object.

In the steam turbine no such loss occurs as that due to cylinder condensation in the reciprocating engine. The steam passes in continuous course through the turbine so that the metal surfaces assume a constant temperature corresponding to that of the steam passing. There is condensation in the steam turbine, and it has been found advantageous to prevent such condensation by superheating the steam. But this condensation is due not to the cooling effect of the metal surfaces, but to the transformation of the heat into mechanical work during the expansion of the steam.

Is there any loss in the reciprocating gas engine that is analogous to the losses due to cylinder condensation in the steam engine? The range of temperatures between the temperature of the ingoing mixture and that reached immediately after explosion is much larger than in the steam engine. But the transfer of the heat from gas to cylinder wall is less rapid per degree difference of temperature for a unit surface than in the case of moist steam. That there is a considerable loss due to the heat transfers to and from the cylinder walls seems certain, although the exact amount is hard to determine. The heat thus lost would in large measure be carried away by the exhaust gases. For, when expansion takes place during the working stroke, the temperature of the gases drops rapidly and at the end of the stroke, when the exhaust valve opens, the temperature is hundreds of degrees lower than at the instant following explosion. Consequently a large part of the heat which is given to the metal surfaces at the time of the explosion is absorbed by the gases again during the latter part of the expansion stroke and during the whole of the exhaust stroke. A portion of the heat transferred to the cylinder walls is absorbed by the incoming fresh charge and is in a sense recovered. The losses due to the varying temperatures of the gases in the cylinder of the reciprocating gas engine would be avoided in a gas tur-

bine for the same reason that similar losses are avoided in the steam turbine.

Another large loss in a gas engine arises from the necessity of cooling the cylinder artificially. There is some loss from a steam engine cylinder by radiation and contact of air, but it is reduced to a minimum by the use of non conducting coverings. The temperature of the steam is not so high that it is necessary to cool the cylinder walls in order to protect them. But in the gas engine it *is* necessary to cool the cylinder artificially in order to protect the metal. This is usually done in large engines by circulating water through a suitable jacket about the cylinder. Not only is the amount of heat lost in this way greater per unit of cylinder surface, but the heat loss is greater also by reason of the greater extent of cylinder surface per unit of power developed. For in the steam engine work is done in every stroke, while in the gas engine only one stroke in four is a working stroke.

Two papers in vol. XXI of the Proceedings of the American Society of Mechanical Engineers furnish very interesting data for comparing the losses in the common forms of gas engine and steam engine. One of these is a paper by C. H. Robertson entitled "An Efficiency Test of a 125 Horse-Power Gas Engine." The other paper is "A Test of a 15,000,000 Gallon High-Duty Pumping Engine at Grand Rapids, Mich." by M. E. Cooley.

For the gas engine the heat account is as follows:

ENGINE DEVELOPING 110 HORSE-POWERS.

Per cent. of heat converted into work	17.85
Per cent. of heat absorbed by jacket	25.18
Per cent. of heat in exhaust gases	56.94

ENGINE DEVELOPING 88 HORSE-POWERS.

Per cent. of heat converted into work	20.24
Per cent. of heat absorbed by jacket	36.93
Per cent. of heat in exhaust gases	42.70

ENGINE DEVELOPING 52 HORSE-POWERS.

Per cent. of heat converted into work	16 04
Per cent. of heat absorbed by jacket	50.35
Per cent. of heat in exhaust gases	33 13

For the steam engine the following heat account is given:

FULL-SPEED TEST.

Per cent. of net heat converted into work	18.47
Per cent. of net heat lost by radiation	2.56
Per cent. of net heat in the exhaust	79.32

HALF-SPEED TEST.

Per cent of net heat converted ino work	17.77
Per cent. of net heat lost by radiation	3.26
Per cent. of net heat in the exhaust	79.95

QUARTER-SPEED TEST.

Per cent. of net heat converted into work	17.10
Per cent. of net heat lost by radiation	5.17
Per cent. of net heat in the exhaust	77 97

In both the gas engine and the steam engine, the loss of heat through the cylinder walls becomes a greater *percentage* as the power developed decreases. This is to be expected because such losses should be nearly constant in amount and therefore the relative loss is greater, the smaller the power developed. The loss to the jacket water in a gas engine is about ten times as great in proportion as the radiation loss of the steam engine. Consequently if by any means such losses can be avoided, a marked improvement in the efficiency of the gas engine should result.

In a gas turbine this loss would probably be greatly reduced because the gases would pass so rapidly through the working parts of the turbine, that if it were necessary to cool the metal at all, the proportion of cooled surface to the power developed would be much less than in a reciprocating gas engine. It is possible also that the parts exposed to the highest temperatures may be constructed of refractory material and not require artificial cooling.

Some calculations and tests with a particular form of gas turbine were published by W. O. Amsler in The Sibley Journal of Mechanical Engineering for May 1900. The particular form of turbine described was one in which two explosion chambers were used in the following manner. A large inlet valve for taking in the explosive mixture was provided. The discharge took place through a nozzle which directed the jet of issuing gas upon the vanes of a suitably constructed impulse wheel. The explosive mixture was taken in at atmospheric pressure and

ignited producing a considerable pressure, which forced the gases out through the nozzle. After the pressure had dropped to atmospheric, the further rapid cooling produced a partial vacuum which caused the inlet valve to open and admit a fresh charge of the explosive mixture. An igniter in the center of the chamber was in continual operation so that when the fresh mixture reached the igniter, the gases were exploded. The resultant pressure closed the inlet valve and caused another discharge of gases through the nozzle. By the use of two explosion chambers a more nearly continuous discharge was produced.

A little consideration of the cycle of operations of this proposed form of turbine shows that it is equivalent to the most inefficient type of reciprocating gas engine, namely that in which there is no compression of the charge before explosion. Add to this the fact that the velocity of the issuing jet varies from a maximum to zero with each explosion, so that the conditions of an efficient turbine cannot be fulfilled, and it is seen that little is to be expected from this form of gas turbine in the way of economy of operation.

The cycle of operations which appears most promising for a gas turbine is quite different from that of the reciprocating gas engine. The condition for the efficient operation of a turbine wheel is that the velocity of the blades of the wheel should be in the neighborhood of one-half that of the jet of gases. Since for most practical purposes an engine is required to run at a constant speed, it follows that the velocity of the jet should also be constant. To obtain a constant velocity of the jet it is necessary that the pressure producing that velocity be maintained constant. This leads to the conclusion that the gas should be burned at constant pressure instead of being exploded as in the common form of reciprocating gas engine.

An investigation of the theoretical efficiency of a gas engine where the combustion takes place under constant pressure shows, that for the same initial temperature of the ingoing mixture and the same maximum temperature reached after the combustion, the efficiency for a constant pressure cycle is the same as for a constant volume or explosion cycle if the ratios of compression and expansion are the same in the two cases.

The type of machine which is indicated by the above considerations is one in which the air and gas are first compressed to the pressure under which it is desired to work and are delivered to a suitable combustion chamber. The mixture is then burned continuously in this chamber. The burnt gases pass out through suitable expanding nozzles, acquiring a high velocity and impinge upon a suitable wheel.

To obtain a definite idea of the conditions involved, let it be assumed that the working pressure is 95 pounds per square inch absolute ; that a gas is used which has a calorific value of 662 British thermal units per cubic foot at 52° Fahrenheit, and a density equal to .412 as compared with air ; that 13 volumes of air are used with one volume of gas ; and that the initial temperature of the ingoing mixture is 69° Fahrenheit. Take the specific heat at constant pressure of the explosive mixture and also of the burnt gases as .25 and the value of γ as 1.4.

The heat developed by one pound of the ingoing mixture is found to be 644.1 British thermal units equal to 501,100 foot pounds.

The first operation is to compress the mixture. If atmospheric pressure be taken as 15 pounds per square inch, the temperature reached at the end of the compression will be 437 degrees Fahrenheit. The net work required to compress one pound of the mixture is $C_p(\tau_1 - \tau_2)$, where Cp is the specific heat at constant pressure expressed in foot-pounds, τ_1 and τ_2 are the absolute temperatures at the end and at the beginning of the compression respectively. Substituting numerical values gives $.25 \times 778(898 - 530) = 71576$ foot-pounds.

The next operation is to burn the mixture under constant pressure. The temperature and also the volume of the gas is increased by the added heat due to combustion. The temperature reached will be theoretically equal to $437 + \frac{644}{.25} =$ 3013 degrees Fahrenheit, or 3,474 degrees absolute.

The next step is to allow the burnt gases to expand down to atmospheric pressure in a suitable nozzle. The temperature at the end of the expansion, which is assumed to be adiabatic, will be 2050 degrees absolute or 1589 degrees Fahrenheit. The entire work done during the expansion will be, as in the case of the compression equal to C p $(\tau_3 - \tau_4)$ equal to $.25 \times 778$ (3474—2050) or 277,000 foot-pounds. This work is done in giving velocity to the gas issuing from the orifice. If there are no losses, the kinetic energy of the jet per pound of gases should equal 277,000 foot-pounds.

The velocity of the issuing gas can be calculated by the formula (*see Wood's Thermodynamics, p. 82*) $V = \sqrt{\frac{2g.\ \gamma}{\gamma - 1}\ .\frac{P_o v_o}{\tau_o}\left(\tau_1 - \tau_2.\right)}$ Substituting numerical values gives:

$$V = \sqrt{64.4 \times \frac{1.4}{.4}\ .\ \frac{2116 \times 12.93}{493}\ (3474 - 2050)} =$$

4220 feet per second. The kinetic energy in a pound of gas moving with this velocity equals $\frac{(4220^2)}{64.4}$ or 276,600 foot-pounds. This checks with the work done during adiabatic expansion in the nozzle, namely 277,000 foot-pounds.

The theoretical efficiency of the compression, combustion and expansion in the nozzle is equal to the kinetic energy per pound of the issuing gas, minus the work required to compress one pound of gas, i. e., $\frac{277{,}000 - 71{,}576}{501{,}000}$ equal to .41.

There remains to be considered the question as to what proportion of the kinetic energy of the jet of gas can be utilized by the turbine or impulse wheel. Assuming the most efficient form of vane, i. e., a cup-shaped vane, the work done on the vane equals $(1 + \cos \beta)\ W\ \frac{(v - u)\ u}{g}$; in which β is the angle which the last element of the vane makes with the reverse of the direction of the jet; W is the weight of fluid considered, in this case one pound; v is the velocity of the jet; u is the velocity of the vane; and g is the acceleration of gravity. Substituting numerical values and taking β at 20° and u at 1,000, gives for the work transferred to the vane per pound of the issuing gas: $\frac{(1 + .94)\ (4{,}220 - 1{,}000) 1{,}000}{32.2} =$ 194,000 foot-pounds.

This gives for the theoretical efficiency of the turbine alone 194,000 divided by 277,000, or .70, and for the theoretical efficiency of the entire machine as a gas engine, 194,000 minus 71,576 divided by 501,000, or .244.

The indicated efficiencies found by C. H. Robertson in the paper quoted above varied, from 16 to 20 per cent. It appears, therefore, that there is sufficient margin between the actual efficiency of reciprocating gas engines and the theoretical efficiency of the gas turbine to give promise that the gas turbine may develop into a valuable machine.

It remains to point out some of the difficulties involved in the practical construction. The velocity of the turbine vanes has been assumed to be 1000 feet per second. To run safely at this enormous velocity a special form of wheel must be constructed and the very best of materials must be used. Velocities of this order have been used in the De Laval steam turbine, and are consequently considered to be practicable.

A more serious difficulty arises from the high temperature of the gases when they strike the turbine. In the above calculations this temperature was found to be 1,589 degrees Fahrenheit, which corresponds to a cherry red heat. It has been found that the strength of iron and steel falls off very rapidly when the temperature rises above 600 or 700 degrees Fahreheit. Consequently the temperature of the metal of the wheel should not exceed 700 degrees Fahrenheit. Whether this difficulty can be overcome is one of the questions to be determined by actual trial.

Another difficulty is to provide an efficient speed-reducing gear. Evidently the compressor must be operated at a very much lower speed than the turbine wheel, so that not only the useful work but also the work required to compress the gases must be transmitted by the speed-reducing gear.

Doubtless other practical difficulties not to be anticipated will be encountered in the working out of the gas turbine problem, but it would be rash to predict that a satisfactory solution cannot be obtained.

A Trip Around The World.

By C. R. PUTNAM.

GENTLEMEN:—You ask me for an article for THE TECHNIC, but instead I send you some rambling notes regarding a recent voyage, which may be of interest.

I left Manila last March and returned here in August, going eastward around the world. The steamer from Manila to San Francisco was the "Korea," at that time the largest on the Pacific, and it is some satisfaction to Americans who properly bewail the lack of a merchant marine, to know that this ship is American built and under the American flag, and is as fine and comfortable a vessel as one need look for. It, however, took thirty-five days to reach San Francisco, because of the numerous ports at which calls are made; Hongkong, Shanghai, Nagasaki, Kobe, Yokohama and Honolulu. A direct line to Manila is much needed, since in that way the voyage could be made in about half the time.

Hongkong is a remarkable example of a successful colony. It was a spot neglected by the Chinese, but in little more than half a century it has become the fifth port in the world in the amount of its shipping. It contains substantial buildings, large dry docks and ship yards, and various factories. Its residence district is mostly on the "Peak," a ridge rising abruptly back of the city to over 1400 feet. This is covered with substantially built paths, houses, fortifications, etc., and it is a remarkable fact that all the material for these works has been carried up the "Peak" on the shoulders of coolies, and much of it by coolie women.

Shanghai is another well built and rather modern looking city. Here also are large docks and factories. Chinese labor is almost exclusively used, only the foremen being Europeans. The anchorage for large vessels is at Woosung in the Yangsti-Kiang River, and at this point one can scarcely realize he is in a river at all, so distant is the opposite shore.

At the three Japanese ports little evidence of the war was seen, beyond a liberal display of flags, and little Japanese tots marching around with wooden guns, much as they might in any other country. Nagasaki is the principal coaling port in the Orient, having large mines in the vicinity. The coaling of a vessel at Nagasaki is a remarkable sight. Men, women and children pass the coal in small baskets from hand to hand along lines formed from the coal barges to the vessel's bunkers; as many as a thousand persons are sometimes employed on one vessel, and coal has been put aboard at the rate of 250 to 300 tons per hour.

From Yokohama I had an opportunity to go to

Tokio for part of a day, and saw the army of war correspondents at the hotel, unable to get to the front. The members of parliament were returning from the session, opened by the Emperor, to provide for the war, and although it was about noon they were all in silk hats and full dress, but the Japanese are very ceremonious, and with their elaborate greetings and farewells, make one feel as though we were a rather abrupt people. I did not have time to look for my classmate, Tsuji, (R. P. I. '90), but I had seen him in Tokio in 1902, when he was most courteous to me. He has a bright young son whom he is teaching English.

Honolulu is one of the garden spots of the world, and is made very comfortable by a splendid electric railway system and elegant hotels. The departure of a large steamer is an interesting sight, as the passengers and their friends on the dock are bedecked with wreaths of flowers, with the municipal band playing.

And then we passed through the Golden Gate and again set foot in a land which one appreciates and values the more the further he travels, One must travel far to see scenes more pleasing than the blossoms and poppies of California in the spring time, or the rolling fields of Iowa, or the foliage of Washington. A few years had wrought changes; to travel over an oil sprinkled railway with an oil burning locomotive, to go to the rim of the Grand Canyon by rail and to the bottom of the great chasm by a good trail, to see advances in many lines at the great exposition, to note the rapid growth of Washington, to walk over the magnificent new Brooklyn bridge, all evidenced the progress made during my few years of absence.

A few weeks and I was passing Sandy Hook on one of the racers, a vessel which kept up a continuous speed across the Atlantic of nearly 23 knots, had seats for 415 persons in the dining saloon, and was in communication every day with distant vessels. Consuming over 500 tons of coal per day this vessel was but a great machine for speed. To look over her stern reminded one of Niagara; a visit to the engine and fire rooms showed why she could carry no cargo. There is probably more comfort on the larger vessels which take a day longer, burn only about half as much coal, and have much less vibration.

We were landed at Plymouth in the morning and a special train put the passengers in London by noon; it took us that long to get through the custom house alone at San Francisco. We may boast of our railway trains, and they are unsurpassed, but the English have the substantial tracks and roadbeds. Those little, old-fashioned coaches, still imitating the stage coach of years ago, were moving along at a steady speed of over 50 miles an hour, and yet the motion was scarcely perceptible. What first impresses an engineer in London is the lack of all surface and overhead tracks; it scarcely seems possible that the largest accumulation of people in the world could successfully get about without these means of transportation. But there is really no such congestion of people in any part of London as in the business districts of many of the large American cities, and owing to geography and building laws there probably never will be.

I crossed the English Channel on a turbine steamer. This vessel was driven at a speed of 23 knots by three turbine engines, one shaft and propeller amidships, and one on either side, making 450 to 500 revolutions a minute. Engines for going astern were mounted on each of the side shaft abaft the go-ahead engines, but the vessel could go astern only about half speed. The engine room was a very great contrast to that I had just seen on the ocean racer. Nothing was visible of the moving parts except the governors and the shafts. The half cylindrical casings of the engines rose only four or five feet above the floor, and left plenty of room on every side. The engineer told me the engines had recently been opened for the first time in twelve months, and everything found in good shape. There was very little vibration on the vessel.

I crossed France and Spain to Gibraltar, stopping a few days in Madrid. Even on the best trains this railway service is very inferior, and the charge for first-class and sleeping car nearly

double those in America. In parts of Spain are seen fine roads, and excellent masonry work, and in southern Spain, the railroad passes some fine examples of aqueducts, both of Roman and Moorish construction. Approaching Gibraltar, an interesting feature is the great forest of cork oak, from whence most of the cork of commerce comes. Gibraltar itself is teeming with military engineering works, both in the great naval station and the fortifications upon the rock, most of which are not open to inspection.

At Gibraltar I boarded the German mail steamer which was to be my home for over a month; this vessel was well fitted for comfortable travel in the tropics. Stops were made at Genoa, Naples, Port Said, Suez, Aden, Colombo, Singapore and Hongkong. From an engineering point of view the harbor works at the Italian ports and at Colombo were of interest, but of course the Suez Canal comes first. This canal is cut through a sandy desert country, and parts of it pass through lakes and lagoons. The traffic is steadily increasing and the profits have become large; the tolls are very high, those paid by our vessel of 8,000 tons being about 51,000 francs for the single passage. About 18 hours were consumed, several stops being made for passing vessels. Vessels are not allowed to pass with both under way; one must make fast to the bank. The canal is operated much like a railway, there being telegraph stations at frequent intervals, where vessels are signaled orders in regard to passing other vessels. Constant dredging and bank improvements are going on, and dredges were seen at short intervals.

Along the canal, the Red Sea and the coast of Arabia, the country appears a complete desert. We landed at Aden, a British outpost on the southern coast of Arabia, and saw a very uninviting looking settlement. The inhabitants comprise a great variety of races, as is the case in all the English Oriental colonies. Colombo, or Ceylon, is one of the prettiest settlements in the east, the town having a park-like appearance with winding roads and pretty villas. Singapore, within a degree of the equator, is an important commercial port, as its geographical position compels nearly all the shipping of this part of the world to call. The principal tin producing region of the world lies back of Singapore. This colony is a good illustration of the effect of unrestricted Chinese immigration, as the Chinese have become the predominating element, and the original Malay inhabitants will probably disappear in time.

At Hongkong I changed to a smaller steamer, which two days later landed me in Manila, where I am again engaged in the interesting task of trying to improve the charts of the Philippine Islands.

A QUICK REPAIR JOB.

L. L. Helmer, '01.

The accompanying photographs may be of interest to some of the readers of the TECHNIC, as showing a quick, cheap and effective method of repairing a cracked steam chest on a Corliss Engine.

The engine shown is an 18"x42", Rarig corliss, direct connected to four stands of cold rolls.

A short time ago a small crack showed itself in the side of the steam chest and, although insignficent at first, it soon spread until it extended almost the entire length of the chest, stopping at each end just short of the valves. We tried calking the crack from the outside with lead a number of times, but each time it would last only a day or two and the lead would blow out. We also began to fear that the chest might give way and not only cause serious damage, but injure someone, as there is always a large number of boys working within a short distance of this engine.

It was a case of either getting a new cylinder and steam chest—they are both cast in one piece—or of devising some means of repairing the old

one. To get a new casting meant the closing down of our finishing departments for at least two or three weeks and, in addition to this, a considerable outlay of money. We cast about to find some satisfactory solution of the difficulty and finally hit upon the plan shown in the photograph.

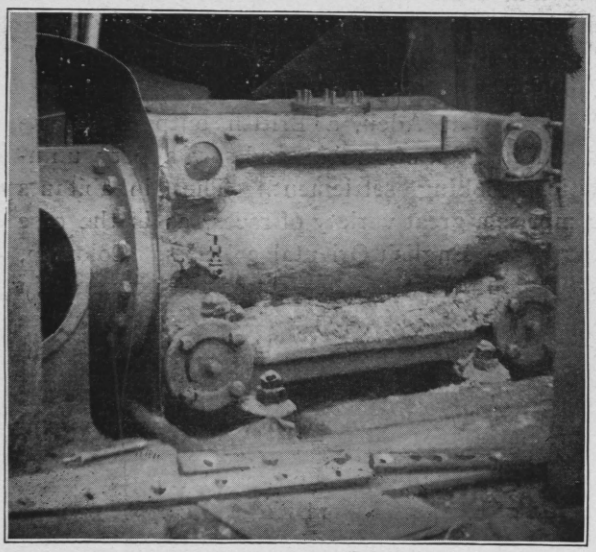


FIG. 1.

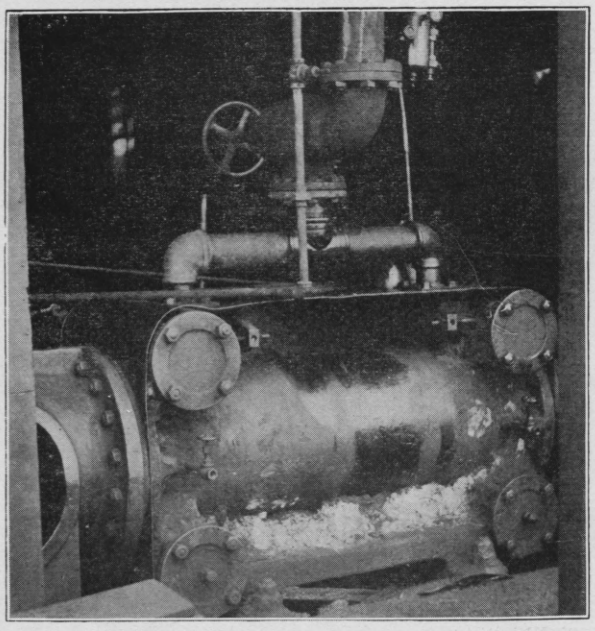


FIG. 2.

Briefly, this consisted of cutting out the steam chest entirely and blanking over the ends. Holes were then cut in the top of the stub ends of the chest, just outside of the valves.

Photograph No. 1 shows the chest with the crack in the side, after it had been cut off at one end. No 2 shows the completed job, before the packing and casing had been replaced about the cylinder.

The time required to do the whole job was less than forty-eight hours and the cost did not exceed $15. The engine works equally as well as it did before it was broken and we have not had the slightest trouble with any of the joints or connections leaking.

ALUMNI NOTES.

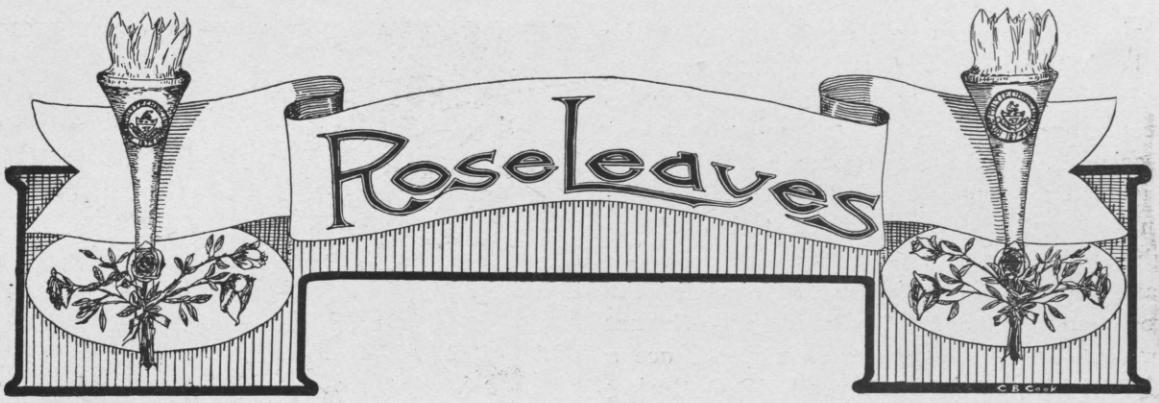
W. Offutt Mundy, class of '95, is now Commercial Engineer for the Westinghouse Electric and Manufacturing Company at Pittsburg, Pa.

J. Charles Young, '92 is General Superintendent of the Saginaw-Bay City Railway and Light Co., with headquarters at Saginaw, Mich.

Harry T. Paterson, of the class of '96 who withdrew at the end of his junior year on account of ill health, visited the Institute recently after an absence of nine years. He lived in Colorado until his health was perfectly restored and has been for some time connected with the U. S. Geological Survey.

Mr. Buckner Speed, '94, intends to resign his position as engineer with the Southern Pacific Railway and enter the University of California as a graduate student in Physical Chemistry, finally working his way into its corps of instructors.

Mr. Edward C. Kirby, '03, has recently left the General Electric Company. He has been engaged by them on turbine work in the south, which being completed, he preferred not to return to experimental work.



The Hawaiian Islands as a Field for Engineers.

By CARL B. ANDREWS, '08.

THE Hawaiian group comprises eight inhabited islands which lie in the Pacific Ocean between 18° 54′ and 22° 15′ north latitude and 154° 50′ and 160° 30′ west longitude. They have a total area of about 6,500 square miles and a population of about 154,000.

The greater part of the work in engineering lines which is done in these islands is called forth by the needs of the sugar plantations. There is a certain amount of engineering work done by the government, but as that done by the territorial authorities is limited to the Bureau of Public Works and the Survey Department, the personnel of the employees in both of which is determined somewhat by political conditions, and the work done by the federal government is performed by either military, naval, or civil service engineers, this class of work need not be dwelt upon in this article.

There are in the group fifty-eight sugar producing companies, the total area under cultivation by them in 1901 being 78,618 acres, which yielded an output of 359,133 tons of sugar. The plantation companies employ civil engineers in the construction of irrigation works, when running streams in the mountains are available. Naturally, also, a plantation must be surveyed, though when once done, this work need not be repeated. There is work for a man and transit after every plowing, in the laying out of new irrigation ditches, but this work hardly requires the services of a skilled engineer, and does not command an engineer's salary. Mechanical and electrical engineers find their work about the mills and pumping stations.

The mills vary in size from small ones, with a capacity of twenty tons of sugar per day, to the latest mammoth mill, at Puunene, Maui, which can turn out five hundred tons in twenty-four hours. The larger mills contain ample material for the exercise of the brain of a mechanical engineer. Electrical appliances are not, as yet, used very much in the mills, the plant being usually called upon only to furnish light, and sometimes to operate motors in isolated places. The pumping stations are a part of the irrigation system of those plantations which draw their water from artesian wells. These pumps are of standard American make, and in may cases quite large; the lift of a pump is between 200 and 600 feet. After these pumps are erected, however, there remains nothing but the running of them, and as in the case of the civil engineer, this is hardly worthy of consideration by a skilled man.

Chemists are employed by the plantations for about three months of the year; that is, during the grinding season; their work being principally to test the quality of the output.

Agricultural chemistry has done a great deal for the sugar industry in the islands. The

chemists who are engaged in the study of the needs of the soil with regard to fertilizers are not employed by the plantation companies directly, but by the Hawaiian Sugar Planters' Association, which includes practically all of the companies, and which has several chemists constantly at work at an experimental station at Honolulu. The results of their researches are given to all the companies which are members of the association. It might also be mentioned that representatives of all the members meet once a year at Honolulu (for several days) during which time papers of interest to sugar producers are read, and any new contrivances which save material or labor, which may have been devised during the year past are described for the benefit of all; not only this, but every opportunity is given for examination of the new mechanism in operation.

The Honolulu Iron Works carries on a business which has had its growth in connection with that of the sugar industry. They import all of their raw material, and manufacture mills, engines, pumps and furnish mill equipments complete. This firm is the largest employer of mechanical engineers in the group.

The general knowledge possessed by an engineer who works in the Hawaiian group needs to be supplemented by some special knowledge of the conditions under which his work will be put to the test. There is a story of a civil engineer who, about ten years ago, located a reservoir for a plantation, in a nice, inviting hollow where practically no work on retaining walls was necessary. Everything about it seemed to have been prepared by Nature, but when it was filled with water, the porous lava rock underneath, full of cracks and bubbles, let it all out during one night; and the unfortunate engineer packed his trunk and went elsewhere.

When a competent engineer obtains a situation on the islands, his employers usually endeavor to retain him, for it is expensive to import men; but the incompetent man will do well to stay away, for one can hardly walk back when the pinch comes.

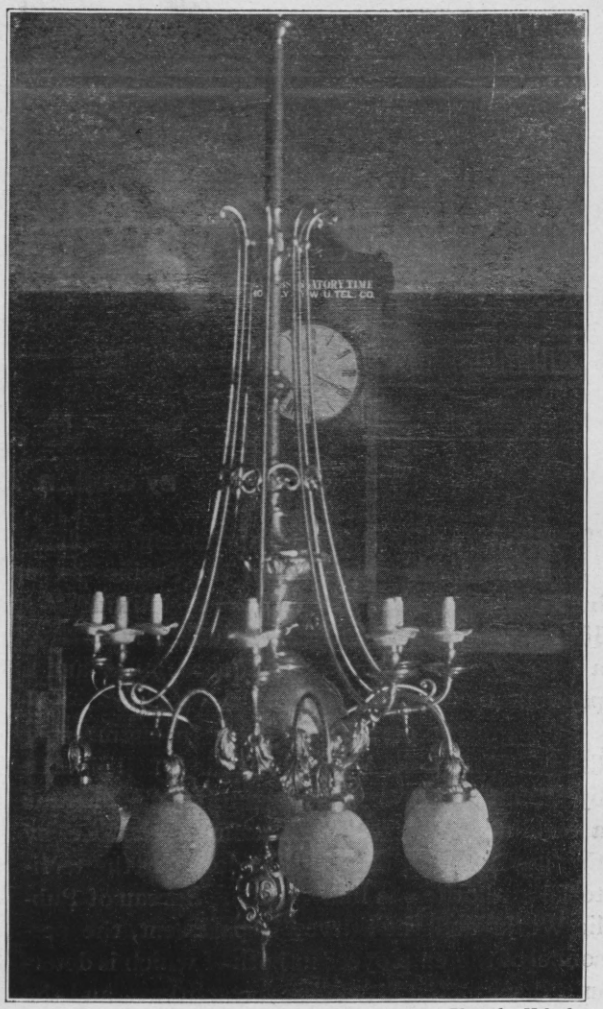


Photo by Kelsal.

The accompanying cut is of the 1906 monument which properly should have been shown in the November issue of THE TECHNIC, but owing to delay in arrival of cut, it was impossible.

THE SOPHOMORE BANQUET.

J. R. Stalker—'07.

On Friday evening November 11, at the Naylor-Cox hall occured the long-looked-forward to Sophomore Banquet, and every one who was present declares that it was a "howling" success, in more ways than one. The class left the Institute at 3:30 and marched in a body to the hall, where they occupied themselves with cards, cigars and magazines, until 8:30, when caterer

Sandison announced that the banquet was ready. Toastmaster Brannon called for the following toasts, which were responded to amid cheers from the fifty-one supporters of old '07 present:

Faculty . . . . . H. H. Orr
Pipe Rushes . . . . . M. L. Goodman
Athletics . . . . . C. N. Trueblood
Class of '07 . . . . . E. J. Miner
Ladies . . . . . H. L. Davies

But one effort was made by the Freshmen to cause trouble, and it was exceedingly weak, the only result being a smashed window. The affair broke up about midnight with nine 'rahs for Alec, the speakers of the evening, the waiters, and nearly everything in sight.

The Y. M. C. A. has prospered to quite a degree this fall, in the attention paid to the meetings and general interest shown toward the work. But the association is not satisfied even yet and hopes to be able to increase its usefulness. There is a natural tendency upon the part of everyone to neglect this side of the daily life, but afer a short while in college most men see the need of the association's influences. It is quite gratifying to see, however, that many of the fellows have awakened to the fact that it does pay to take an interest in the association.

As was mentioned in the November TECHNIC, the State Convention of Y. M. C. A. was held at Marion, Ind., from the 16th to 20th. The two delegates from Rose were K. D. White, '06 and C. W. Post, '07. Both men report a pleasant and profitable time. There were about two hundred and fifty delegates attending this convention, representing about twenty-five colleges and as many city associations. Earlham sent the largest college delegation.

A stag social was given on the night of Nov. 22, in the Y. M. C. A. wing on the third floor of the main building. The evening was very enjoyably spent.

The desires of the inner man were not neglected in any way, as a general and liberal supply of refreshments was on hand.

BASKET BALL.

M. R. R., '05.

NOW that the foot-ball season is past and its events are matters of history with us, all eyes naturally turn to basket-ball and you are beginning to hear on every hand, "How's the team coming on?" and similar questions. We again read in the papers and college journals articles starting out something like this: "Never before in the history of the college have the prospects," etc. But in speaking of our outlook, let us avoid this old stereotyped announcement, and simply say—"Just watch our smoke."

The older students surely are familiar with the records of the basket-ball teams heretofore, but for the benefit of students recently entered, it may be said that they have been very good and compare favorably with the records of other Rose teams, and in turn this team has been one of the best supported.

The interest that has been manifested by the students so far this season has been gratifying indeed, the number reporting for practice being such that several teams are readily chosen for the practice games. However, there are still some men who have not reported for practice that should, and anybody who has ever played or has any idea that he would like to play, will be gladly welcomed on the floor.

While some difficulty has been encountered in preparing the schedule, it is hoped that sooner or later games will be arranged with all the leading colleges in the state. In order that we may finish at the top in the race for the honors, the co-operation, encouragement and support of the entire student body, and the steady and conscientious practice on the part of the players is necessary. So let every man be a booster; you will feel better for it.

Here a word is desired with the student body and all their friends. Many of you will doubtless remember the unpleasant affair which occurred at the close of a game with a visiting team last season, and since but few realize the extent of the damage caused by such a belligerent spirit, it may be well to cite it here. It matters not whether the scene was caused by Rose students or outside spectators, the fact remains that you are held responsible for it, and a few such demonstrations bring more ill repute upon the Institution than can be dispelled by several seasons of clean, gentlemanly sport and courteous treatment of visiting teams, to say nothing of the troubles and difficulties it heaps upon the next year's manager in preparing a schedule. As one consequence of this trouble, no game is arranged with this team during the coming season, this affair being used as an excuse to hide the true reasons for refusing to meet us. Hence every student should not only guard himself against such an outbreak, but should also prevent any other spectator from causing an unpleasant scene.

Everyone will admit that the sense of justice and fair play exhibited by that team was deserving of the utmost contempt and disgust on the

part of any audience, for no team infused with a love for clean and honest sport would choose and then permit to continue as an official, a man of the calibre of him who posed as a referee that night. Such a spirit should of course be vigorously condemned but in doing so let no Rose man make the grievous error committed by certain of those present in attempting to take matters into their own hands. In order to obtain justice and the respect and support of the public in general under such circumstances, we must be entirely free from blame ourselves, and one of the best ways to accomplish this is to allow the management of the team to conduct its own affairs unhampered. Surely the interests in the welfare of the team of those intrusted with its care is not less than yours.

It is however very gratifying to know that it is doubtful if any man at Rose today has ever been guilty of any such actions and no reoccurrence of such a scene is anticipated, but it was thought well to portray the far reaching effects of such evils and to ask the aid of every Rose man in defeating the attempts of anyone, whether he be a student or not, to cause any unpleasantness at our games.

All our scheduled games will be played in the gymnasium of the local Y. M. C. A. on Ohio street, because of its convenience, central location and superior facilities for taking care of spectators.

With the help and encouragement of the students and their friends in general there is every reason to believe that this season will be a pleasant and profitable one.

One of the most sensational foot-ball seasons ever seen at Rose has just been finished. With a total of 59 points against to 12 in favor of her in the first four games played, Rose adopted a new system of play, and started an uphill fight. The results are shown better in the records of the games below than they can be told. It is enough to say tht when the season ended Rose had scored 81 points to her opponents 69.

ROSE, 23; EARLHAM, 4.

By F. N. Hatch, '03.

With the odds slightly against them, the Rose team defeated last year's champions by the score of 23–4.

Earlham's gains were made mostly on end-runs, while Rose's were the results of line plays and quarter-back runs.

As in their preceeding games this season, Earlham was able to score only by a goal kicked from the field.

Lawrence and Hobbs for Earlham, and Lee, Benbridge and McBride for Rose were the stars, though all the Rose men played excellent games. Schmidt kicked 50 yards to Earlham at the sound of the whistle. Earlham, by steady playing, was then able to work the ball down the field as far as Rose's 6 yard line where they lost it on downs. Lee gained 10 yards around their left but the Poly was forced to punt soon afterward, recovering the ball, however, in a short time by Earlham's ina- bility to gain. After a few plays, Lee carried the ball to the center of the field by a quarter-back run, and a little later made a touch down by a 40 yard run around our right. Douthett punted out to Lee, who failed to kick goal. Schmidt kicked the ball over the goal line and then Earlham kicked out from the 25 yard line to Benbridge who returned the ball 10 yards. Benbridge and Lee brought the ball up to within a few yards of the goal and Benbridge went through for a touch down. Lee kicked a goal.

Score 11–0.

On the next kick off the pigskin only went 25 yards and after gaining about 15 yards Earlham was forced to punt. Lee, McBride, and Douthett made good gains and when time was called at the end of the first half the ball was in the middle of the field.

Opening the second half, Earlham kicked 40 yards to Wilms, who returned the ball 10 yards. After gaining 25 yards more, Rose lost on downs, but Earlham was unable to make sufficient gains and tried a punt, but it was blocked. Several good gains and Rose was ready for a touch down,

Cook being shoved over the line. The goal kicked by Lee brought the score up to 17–0.

On the next kickoff, Earlham gained steadily until she reached Rose's 15 yard line, where, failing to gain, Lawrence tried a place kick for goal and failed.

Rose kicked out from the 25 yard line but the Earlhamites soon brought the ball back and Lawrence succeeded in scoring four points on a place kick.

Shortly after the next kick off Peck was hurt and Post took his place. Earlham carried the ball to their 40 yard line, where they made an unsuccessful punt, but soon regained the ball on downs, then lost it again. Lee made a 60 yard dash around their left and carried the ball out of bounds at the one foot line.

Douthett was sent over for a touchdown and Lee kicked goal.

Score, 23–4.

LINE-UP.

ROSE.		EARLHAM.
McBride, (Capt.)	L. E.	Lawrence.
Lammers	L. T.	Reagan.
Heick	L. G.	Smelser.
Speaker	C	Wann.
Schmidt	R. G.	Bond.
Peck, Post	R. T.	Harvey.
Wilms	R. E.	McCarry.
Lee	Q. B.	Wilson.
Cook	L. H. B.	Lear.
Benbridge	R. H. B.	Hobbs (Capt)
Douthett	F. B.	Newlin.

Referee—Daily.
Umpire—Hadly.
Timers—Hall and Albertson.
Lineman—Keily.
Time of halves—25 minutes.
Touchdowns—Cook, Lee, Benbridge, Douthett.
Goals from field—Lawrence, 1. From touchdowns, Lee, 3.

ROSE, 12; INDIANA NORMAL, 0.

By Kelly '07.

Rose finished one of her most successful seasons of foot-ball, on Thanksgiving afternoon, by defeating the Indiana State Normal. Normal had a much heavier team than Rose, but lacked the team work and training which our men had. Short halves were played because of the delay in starting the game.

The first half was a see-saw, back and forth in the center of the field. In this half both teams did excellent work on defense, but on offense Rose had a shade the better of the argument, carrying the ball 112 yards to Normal 74. The second half was all one-sided, Rose out-playing the Normal at every point. During the game Rose carried the ball 296 yards, while Normal advanced it only 125 yards. Daily's work on offensive was the feature of the game, he alone carrying the ball 132 yards. Lee also made some spectacular plays in running back the kicks. Bland, Lammers and Post also did good work for Rose, as did Hamilton and Bash for the Normal.

Capt. Spencer won the toss and chose to defend the west goal. Daily kicked off. McCord received the ball on the 30-yard line and returned it 12 yards before he was downed by McBride. The Normal by smashes through our line and plunges on tackle, by Hamilton and Bash, carried the ball steadily toward Rose's goal, until the 26-yard line was reached; here Normal fumbled, and McBride fell on the ball. Post went around tackle for 3 yards, Lammers added 8 yards to this, and then Daily, on a delayed pass, made 18 yards, and Rose in three plays had the ball in the center of the field. On line bucks Rose made 17 yards more, Lee lost 5 yards on a quarter-back run, and Daily punted to Normal's 34-yard line. Normal by short steady gains carried the ball back 16 yards, where they lost 5 yards for off side play. On the next play they failed to gain and Hamilton punted to Rose's 35-yard line. Lee carried it back 15 yards. Rose lost 5 yards on an end run, then Daily made 15 yards, on a delayed pass. Bucks by Cook, Daily and Bland brought the ball to Normal's 33-yard line, where Lammers fumbled and Normal fell on the ball. Two plays brought them no gain, and Hamilton punted to the center of the field. Rose again, by end runs and line plunges carried the ball to Normal's 35-yard line, where Bland fumbled, and again it was Normal ball. Again, without any gain, they were forced to punt. Lee on a quarter-back run made 8 yards. Here

Normal took a brace and held Rose for downs. After the next play, however, time was called, with the ball on Rose's 36-yard line.

Score—Rose 0; Normal 0.

McCord kicked-off to Rose's 19 yard line. Lee carried it back 23 yards, then with Daily, Bland and Lammers carrying the ball, Rose advanced it to Normal's 47 yard line, where Bland held, and Rose was penalized 15 yards. Daily punted to McCord at the Normal's 25-yard line. He returned it 5 yards, Normal unable to gain, punted to Daily, who returned it 6 yards, then by gains of 5 and 6 yards at a time, by Daily, Bland, Post and Lammers, the ball went to Normal's 3 yard line, and on the next play Daily went over for a touch-down. Daily punted out to McBride, who made a fair catch, and Bland kicked goal.

Score—Rose, 6; Normal, 0.

Daily kicked-off to Normal's 11-yard line and Hamilton returned it 19 yards. After two plays, and no gain, Hamilton punted to Normal's 46-yard line. By end runs and line bucks, Rose advanced the ball to Normal's 5-yard line and Bland went over for a touch-down. Bland kicked goal.

Score—Rose, 12; Normal, 0.

Daily kicked to Normal's 7-yard line and Hamilton returned it 13 yards, Normal after no gain, punted to the 40-yard line. Daily then made 8 yards on an end run, but Normal braced, and Daily punted, the ball going out of bounds at Normal's 20-yard line. Normal in two plays made 8 yards, then Rose held them, and Hamilton punted to Rose's 29-yard line. Lee carried it back 26 yards. Normal held Rose, and Bland punted out of bounds to Normal's 42 yard line, but Normal immediately lost the ball. Again Rose was penalized for holding. Daily punted to Normal's 26 yard line, then time was called.

Score—Rose, 12; Normal, 0.

LINE-UP.

ROSE	POSITIONS	NORMAL
McBride (Capt.)	L. E.	Vandover Eddington
Lammers	L. T.	Weatherwax
Heick	L. G.	Klepfer
Speaker	C.	Montgomery
Peck	R. G.	Brice
Post	R. T.	Mattox
Benbridge	R. E.	Mitchell
Lee	Q.	McCord
Daily	L. H. B.	Hamilton
Bland	R. H. B.	Spencer (Capt.) Philips
Cook	F. B	Bash

Summary: Touch-downs, Daily, Bland; Goals from touch-down, Bland (2); Referee, Jamieson, Y. M. C. A.; Umpire, Clevenger, I. U.; Head linesman, Mattox, I. U.; Timers; Day and Ryan.

Time of halves, 25 minutes.

ROSE SECOND, 18; MARSHALL, 0.

The Second Team put up an excellent game against Marshall High School on Nov. 19, outfielding them at every stage of the game. However, the score would probably have been different if Mitchell, Marshall's crack quarter, had not been hurt early in the game.

On the offensive, Keily, Reynolds, Bard, Budge and Cannon carried the ball well, while McCormick and Jackson shone on the defensive.

The game started at 10:30 A. M. Pritchard kicked to Reynolds, who returned the ball 10 yds. Without a halt Rose ploughed down the field, and Budge made the touchdown. Greenleaf failed to kick goal.

Score—Rose, 5; Marshall, 0.

On the next kickoff Marshall carried the ball down the field to Rose's 20-yd. line, and just as a touchdown looked certain, they fumbled, and Reynolds secured the ball. The half ended with the ball in Rose's possession on her own 20-yd. line.

Score—Rose, 5; Marshall, 0.

SECOND HALF.

Rose kicked to Marshall, the ball being downed on Marshall's 38-yd line. Here, on a fumble, Struck fell on the ball, and Poly started ahead for a touch-down; Greenleaf made it after four minutes of play. Goal was not kicked.

Score—Rose, 10; Marshall, 0.

Marshall kicked to Poly; a few bucks, then Bard was through for 20 yds. Rose was forced to kick, Greenleaf making a beautiful punt of 47 yds. Marshall tried an end run, but McCor-

mick tackled the man for an 8-yd. loss. A fake kick was tried, but Mac again had the man, and this time shoved him over for a safety.

Score—Rose, 12; Marshall, 0.

On the punt from the safety it was an easy matter for Poly to score another touch-down aided by 25-yd. run by Reynolds. Bard made the touch-down. Keily kicked goal.

Score—Rose, 18; Marshall, 0.

In the remaining five minutes neither goal was in danger, and the half ended with the ball in Rose's possession on her own 35-yd line.

Final Score—Rose, 18; Marshall, 0.

LINE-UP AND SUMMARY.

ROSE.		MARSHALL.
Bard, McCormick	R. E.	Lake, Ross
Kelly, Cannon	R. T.	Snediker
J. Cannon, H. Cannon	R. G.	Likens
McDaniels	C.	Trimble
Jackson	L. G.	Hanley
Budge	L. T.	Cook
Struck	L. E.	Brown
Keily	Q.	Mitchell, Taylor
Wickliffe, Bard	R. H.	Taylor, Lake
Reynolds	L. H.	Prevo
Greenleaf	F. B.	Pritchard

Referee, Brannon; umpire, Strecker.

Touch-downs—Budge, Greenleaf, Bard. Goal from touch-down—Keily 1.

Time of halves—20 minutes.

ROSE, 22; MILLIKEN, 6.

By F. N. Hatch '06.

Daily kicked 35 yards to Milliken. After returning for 13 yards, Milliken was thrown for a 3 yard loss, then Rose got the ball on a fumble on Milliken's 26-yard line. 8 yards by Daily, 7 yards by Lammers, 7 yards by Benbridge, and after two downs, with no gain, Daily went over for a touch-down. No goal was kicked.

Score—Rose, 5; Milliken, 0.

Daily kicked 52 yards to Milliken, Tobias returning it 17 yards. Milliken was immediately held for downs, and after a few line bucks Rose was over the line, Bland making the touch-down and kicking the goal,

Score—Rose, 11; Milliken, 0.

Milliken received the kick on her 25 yard line. She was immediately held for downs, and punted. Line bucks by Bland, Lammers and Benbridge, aided by a 16 yard run by Daily brought the ball to Rose's 12 yard line, and she was held twice for no gain; then with unbroken interference Lee went around left end for a touch-down. Bland kicked goal.

Score—Rose, 17; Milliken 0.

Daily kicked over the goal line, and Milliken punted from touch-back to Rose's 60 yard line. A 21 yard run and an 8 yard run by Lammers, a few bucks, and Benbridge scored a touchdown. Bland failed to kick goal.

Score—Rose, 22; Milliken, 0.

Daily kicked 45 yards to Milliken, who returned the ball 18 yards. They were immediately forced to punt. After 20 yards, Rose was forced to punt to Milliken. Milliken gained 18 yards and punted 27 yards to Lee, who returned the ball 35 yards. The half closed with a 10 yard run by Daily.

SECOND HALF.

A great surprise was in store for Rose here. Milliken kicked 38 yards to Daily, who returned the ball 12 yards. He followed this almost immediately by a gain of 19 yards. Benbridge and Lammers each made 5, then Rose was held. Milliken was held in about five plays, and Rose advanced the ball by line bucks to Milliken's 12 yard line. Here Milliken recovered the ball, and almost immediately McDavid went down the field for 65 yards, being stopped by Benbridge. Tobias followed with 25 yards, and though it took three downs, Milliken shoved Tobias over and McDavid kicked goal. Time was up.

Score—Rose, 22; Milliken, 6.

LINE-UP.

ROSE.		MILLIKEN.
McBride, (Capt.)	L. E.	McDavid, (Capt.)
Lammers	L. T.	Galbrith
Heick	L. G.	Ross
Speaker	C.	Alberts
Post	R. G.	Beall
Peck	R. T.	Tobias
Douthett, Cook	R. E.	McCollom
Lee	Q. B.	Crea
Daily	L. H. B.	Powers
Benbridge	R. H. B.	House
Bland	F. B.	Moore

SUMMARY.

Referee—Jamieson.
Umpire—Crowe.
Timers—Ryan, Thornton.
Time of Halves—25 minutes.

NOTES.

On looking over some of the old records of foot-ball scores, we find that this season's work compares very favorably with that of any other team since foot-ball was begun at Rose. Four times has Rose scored more points than her opponents, and once has been tied as to points.

In 1893 Rose won one game, 16 to 6; in 1896, in two games, Rose scored 16 to her opponents 12; in 1897, Rose scored 32, and her opponents 32, four games being played; in 1898 the score was 48 for Rose and 32 for her opponents, in four games.

Compared with this we have Rose's record for the past season, 81 points won, to 69 won by opponents in the 8 games played.

The score of games is as follows:

Washington	17	Rose	5
E. I. S. N. S.	16	"	2
Culver	16	"	0
Shortridge	10	"	5
E. I. S. N. S.	0	"	12
Earlham	4	"	23
Milliken	6	"	22
I. S. N.	0	"	12
	Total 69		Total 81

Two decisions made on the local gridiron this year have caused a good deal of argument, and no agreement seemed likely to be reached. It was decided to write to Mr. Walter Camp and Mr. A. A. Stagg of the National Rules Committee, and allow their answer to settle the dispute.

In the first Illinois Normal game, Rose had the ball on Normal's 3 yard line, Rose fumbled, and the ball shot over the heads of the players and Henderson of Normal caught it, and ran into the field of play. Here a Rose man tackled him, and he was thrown back across the line—the referee called this a safety.

The second case was a similar one. When the Poly second played Marshall, Marshall had the ball on her own 7 yard line, a fake kick was tried, but the Rose end tackled the Marshall runner in the field of play, and threw him back across the goal line. Again the question arose as to safety or touch-back.

Mr. Camp's reply was as follows:

"Replying to your first question, it was a safety if the man himself carried the ball across his goal line, whether he were pushed back, or went back of his own accord.

"I don't see the distinction made between the two cases. The point is that if a man carries the ball across his goal line, and then touches it down, it is a safety."

Mr. Camp also stated that by the "impetus" of the ball was meant impetus "from a pass or kick or something of that kind, and not when the man has the ball in his arms."

Mr. Stagg's reply was more detailed—He says:

"In case (1) which you cite, if the E. I. S. N. defensive quarter was thrown back over the goal line before he called down, or the referee gave the ball down, it was safety. Under no circumstances could it have been a touch-back according to your statement of the case. To have been a touch-back it would have been necessary for E. I. S. N. defensive quarter, who received the ball on a fumble, to have been behind the goal line when he received it and to have called it down then and there. If he had been behind the goal line when he received the fumbled ball, he could have run anywhere behind that goal line and been thrown and it would still have been a touch-back. Had he received the ball behind the goal line and then running out into the field of play been pushed back across the goal line again before calling down in the field of play, it would then have been a safety.

"In case (2) Marshall made a safety when the ball was passed back for a fake punt and the man who received it was thrown behind his own goal line."

At a recent general assembly the new track R's—an R in an eight inch circle—were awarded for the season of 1904. Nine points in a dual

meet, three points in a state meet, or their equivalent give a man a track R, provided it is voted him by the Board of Athletic Directors.

The following received R's :

Larkins '05, Peddle '05, Wischmeyer '06, Modesitt '06, Lee '06, Brannon '07 and Douthett '08.

Unckrich '07, who is not at school this fall, was also allowed an R.

The class basket-ball teams have been organized, and so far have made a brilliant record. The Freshman team, captained by Lindeman, defeated T. H. H. S. 38 to 7, while the Juniors under Johnson, have twice defeated the first Y. M. C. A. team. The first time they defeated Y. M. C. A., 19 to 17, and the second time 33 to 12.

BASKET-BALL SCHEDULE.

The basket-ball schedule for the season of 1905, as near as it can be ascertained at this time, will be as given below.

This schedule may be subject to one or two changes, and in addition to the games here announced the date of January 28th will be filled by a game with the local Y. M. C. A. team if arrangements can be made for it.

Jan. 7—Indiana vs. Rose, at Bloomington.
Jan. 9—Hanover vs. Rose, at Terre Haute.
Jan. 13—Wabash vs. Rose at Terre Haute.
Jan. 18—I. S. N. vs Rose, at Terre Haute.
Jan. 21—DePauw vs. Rose, at Greencastle.
Feb. 4—Indiana vs. Rose, at Terre Haute.
Feb 10 or 11—Wabash vs. Rose, at Crawfordsville.
Feb. 18—I. S. N. vs. Rose, at Terre Haute.
Feb. 25—Earlham vs. Rose, at Richmond.
March 4—DePauw vs. Rose, at Terre Haute.

Hail! Santa, Old Scout,
We're glad you're about
To pay us your yearly visit.
We've so long toed the mark
In this old Noah's ark
That your coming seems really exquisite.

The Mid-Term exams
Gave us the jim-jams.
The Profs. were not very magnanimous;
Every one in his wrath,
From the Duke down to Hath,
Took the chance, and rubbed it in ou ns.

We will now forget
To worry and fret,
For our troubles, though great, cannot squelch us.
So loudly we'll sing,
As the Christmas bells ring,
Gaily: Gloria now in excelsis.

THE ROSE POLYTECNIC
GLEE CLUB
At Home
December 16, 1904, 8:00 P. M.
Polytechnic, Thirteenth and Locust Streets.

Burlesque Opera,
"Red Riding Hood."
R. S. V. P.
By securing tickets in
advance at Buntin's
for fifty cents.

At last we are to see the Rose Poly Glee Club in their realistic far famed Burlesque, "Little Red Riding Hood." This production has been played before the crowned heads of Europe and the bald heads of America. The character of the ill-fated little heroine will find expression in the experienced acting of Wilhelmina Heick. F. B. Lewis will interpret the role of the sad-eyed Blue Bell. Harriet Shickel will duplicate in an efficient manner the troubles of Sis Hopkins, while terrible, bold faced bandits, bristling with armament, glide by gracefully.

Other equally popular artists will do justice to the rest of the cast. Dreams of loveliness in color, among them a symphony in yellow, will dazzle the on-looker.

CAST:

R. R Hood	Heick, '05
Mamma	Blanchard, '05
Woodman	Fischer, '08
Grandma	Shryer, '05
Robin	Kahlert, '06
Wolf	Trowbridge, '05
Messenger	Reynolds, '05
Buttercup	Canfield, '06
Sis Hopkins	Shickel, '07
Elsie	Knopf, '08
Bluebell	Lewis, '05
Bandits	Andrews, '08 Kahlert, '06 Post, '07
Consolers	Douthett, '08 Lammers, '08
Old Homestead Quartette	White, '06 Blanchard, '05 Fischer, '08 Lewis, '05
Buster Brown	McCormick, '07
Supe	Hanley, '05

All Polytechnic students in good and regular standing will be admitted free. All are requested, in fact, strongly urged to prove their good and regular standing by bringing a sister, your own or some one's else. Tickets for others than stu-

dents, fifty cents (50c). Don't forget the place and date—Rose Poly, Dec. 16. Be loyal and support the Glee Club.

The Institute will be dismissed for the holidays on Friday, afternoon, December 23d, according to the catalogue.

Worthy (translating French)—"The boy entered the garden and stole some apples off the plum tree."

Sophomore (in Chemistry)—"Rabbit metal is an alloy composed of bismarck and alimony."

QUALITATIVE ANALYSIS.

Test for a Girl's Affections for You.—Collect and concentrate her affections; add a drop of interest by relating some pathetic event. If she dissolves into tears, you may know that she is not of the acid group, and that her specific gravity is great. Now boldly drop your arm around her waist; if she flames up and burns with indignation, it is at once seen that she has been too much oxidized; but if there is a precipitation around your neck, you know that she is of a combinable element. Carefully collect the precipitate, and preserve it for future use.—An exchange.

Absent-minded Junior—"Let me see; tomorrow is Thursday afternoon, isn't it?"

It is said that the Czar of Russia has set aside one million dollars for his newly-born son. A facetious newspaper writer refers to this as the "Fresh Heir Fund."

Paul Turk, '07, has been initiated into the M. E. P.

Worthy—"Frank Daniels is coming soon."

Fischer, '08—"What, are we going to have some fandangles."

LEARNING YOUNG.

Prof. Mac—"My kid can talk Dutch already. Son, say something for Professor Wicky."

Young Mac—"Gesundheit ist besser als krankheit by a damn sight."

IN ELECTRICITY.

"Prof. Wagner—What is sparking?"

Bland—Sitting in the moonlight with your best girl."

Dr. White—"How do you obtain sulphur?"

Sneed—"You get it from the pirates (pyrites.")

Canfield, looking into the fire—"My, but this is a great fire."

Lee—"DeWolf Hopper made his name when Bedillia Fox was with him."

A young lady said to our friend Worthy:

"Mr. Worthington, your mouth is pretty enough to be on a girl."

Worthy—"I never miss the opportunity."

After the exams:

Ryan—"Well, didn't Waggie soak us in steam?"

Bland—"It must have been hot."

Normalite to "Mister" Klenk (during Poly-Normal foot ball game) "Say, pard, don't the ringing of those cow bells make you home-sick? They make me feel that way."

Wilkins, '06—"I will admit that hail stones six inches in diameter is a slight exaggeration, but I have seen watermelons measuring twelve feet in circumference."

Doc (in mechanics) "I want each member of the class to measure the flywheel on the Brown engine and compute the contrifugal force required to break it."

Andrews, '08 (next day)—"I was down at the shops but could find no brown engines, as they were all red engines."

Evans, '06—"I tell you what, fellows, we have

the only boarding place. Why, we even have a Pearl at the end of the table."

Prof. Wickersham spent Thanksgiving with his mother in Emporia, Kansas.

Donald H. Atherton, '05, "our Donald," was seen lately wearing an I. S. N. watch fob. Now while we do not mind eating the Normal (girls') candy and wearing their bouquets in our buttonholes, still we draw the line on wearing their fobs, which publishes the fact that the wearer goes to the I. S. N. and is proud of it. But stick to it "Donald," and may your wish be soon gratified.

It might have been something he had for lunch, or a faculty meeting for the evening which caused Prof. Peddle to straighten up, look at his watch and dismiss the class in Descriptive at 2 P.M. instead of 4 P.M. on December 5th. Pretty bad when two looks like four.

Ask "Rachel," concerning Biederwolf's description of the missing link.

Prof.: "Has any one of you got a steam table?"

Watson: "No, but I've got a slide-rule."

Post to Parr and Benson: (walking down the track) "Get off the track, fellows, those instruments are valuable."

Cook: (running the dumpy-level) "Hey there, Bense! I want the target up, so put it down."

Bard, Garvin and Goodman have joined the Sigma Nu. We haven't heard much about their initiation; however, we note that Sam Garvin has not come on time to a single recitation since.

Mr. Nelson and Doc Glover were initiated into the P. I. E. S. We don't know whether they used the goat on the Professor or not, but Glover certainly did enough for them both. A large crowd was convulsed with laughter at some of the wild antics which he performed. Among other things he had to ride up and down Main street in a tiny auto and blow a tin horn. He had goggles and leather cap—truly—he looked like a full fledged chauffeur.

Lawton (speaking of Lincoln): "Why he began life as a small boy."

Prof. W.: "How did you get along with your problem?"

Speaker: "I don't think there is enough data."

Prof. W.: "What more do you want?"

Speaker: "A little velocity would help it along some."

Exchanges.

The November number of THE POLYTECHNIC has a comprehensive article on Storm Water Sewers of Santiago de Cuba.

The Boston Tech men also have their troubles with the police. That of needless interference on the latter's part.

The University of Pennsylvania has received a "chunk" in the form of $500,000 for current expenses. Also at present she is erecting a $300,000 gym.

Case has received during the past year many new pieces of apparatus. A few of them are twenty 100 amp. hour storage cells, a Westinghouse two-phase rotary converter and a Wagner single phase motor-generator set. Also a consignment of direct-current instruments consisting of five voltmeters and five ammeters.

The Sheffield School has recently received the gift of a new Metallurgical laboratory, from Mr. John Hayes Hammond, a prominent mining engineer. Mr. Hammond has been appointed

Professor of Mining Engineering. The laboratory is now in process of construction and the outside dimensions are to be 80 feet by 200 feet. It is aimed to have plenty of room for the various branches of mining work, such as the assaying, ore-dressing and testing of apparatus. In fact all phases of the mining industry will be thoroughly dealt with.—[*Yale Record.*]

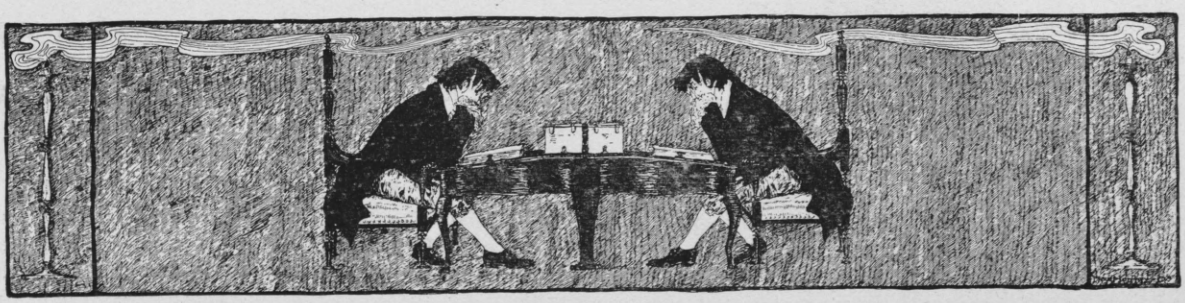
An announcement has been made to the effect that the qualifying examination for the Cecil Rhodes scholarships will be held not later than the 15th of January.

The Republican clubs of Harvard and Boston Tech joined in a grand parade on the night of November 2d. The Harvard men wore long gowns and "mortar-board" caps of bright cardinal, and each carried a torch, while the Tech men were dressed in overall suits, and their straight lines and precise step made quite a hit.

In the near future the banks of the Hudson at West Point will present a new picture, as plans are now in process of execution which will materially change the whole view, Congress having appropriated five and a half millions for the undertaking.

Some of the Case Seniors have begun thesis work.

C. B. C.



REVIEWS

MR. WALTER C. KERR, the head of the engineering firm of Westinghouse, Church, Kerr & Company, delivered an address entitled, "The Point of View," to the graduating class of Stevens Institute of Technology, in June. Rose students would do well to read this address, as it contains some advice which should prove beneficial to all who are contemplating an engineering career. The address is printed in the November issue of *The Electric Club Journal.*

THE *Transactions of the American Institute of Electrical Engineers* for November contains a paper by Mr. Frank F. Fowle on the "Transposition of Electrical Conductors," also the discussion at the St. Louis meeting in September, on "Different Methods and Systems of Using Alternating Current in Electric Railway Motors." At the meeting of the Institute on November 25th, two papers were presented on the subject of "Heavy Electric Traction."

SOME of the papers contained in the *Journal of the Association of Engineering Societies* for September are: "The Laying of the Commercial Pacific Cable"; "Simple Steam Turbine Engines"; "The Reclamation of a Mountain Swamp"; "Pipes and Joints for High Pressures"; Vertical Railway Curves"; and "The Manufacture and Testing of Portland Cement."

THE October issue of *The Proceedings of the Engineer's Club of Philadelphia* contains several very interesting papers.

Mr. Henry Leffmann, in an essay entitled, "George Washington as an Engineer," seeks to bring together facts that will assist in showing that Washington possessed, and in his own day was esteemed for, abilities that are now not often ascribed him. Fac-similies of a number of his drawings and survey maps are reproduced, as are also numerous extracts from the notes which he kept on his surveying expeditions during his early career.

A description of some recent main sewer construction in the City of Philadelphia, together with a number of excellent cuts illustrating their method of construction, is given by Mr. C. H. Ott.

A paper on the general features and the practical operation of the Diesel engine, with crank effort curves, and views showing the construction of the engine, is reproduced in this issue.

Fireproof Floor Construction.

MR. T. J. MONTGOMERY, '98, in a paper read before the Western Society of Engineers, at their September meeting, discussed the fireproofing qualities of concrete as used in floor construction.

It is pointed out that the requirements of an ideal fire proofing material for the protection of structural steel are:

"First—That it shall not itself be affected by fire.

Second—That it shall protect the steel from the effect of fire and heat.

Third—That it shall protect the steel from the effect of corrosion.

Fourth—That it shall go into place rapidly and be easily adapted to unusual designs and details of construction.

Fifth—That once in place it shall resist to the greatest

possible degree all effort to remove it, by either the elements or by human agency.

Sixth—And last, but not of the least importance, in this age of commercialism, it shall do all of these and do them well at a reasonable cost."

The two classes of concrete, stone or gravel concrete, and cinder, or slag concrete are compared as regards their relative value for fireproofing purposes, and the conclusion is reached that in all respects the cinder or slag concrete is the equal or superior of the stone or gravel concrete and is to be preferred.

The paper forms an interesting contribution to the subject of fireproof building construction and is given in full in *Construction News* for November 12th.

Will the Electric Railway Replace the Steam Locomotive?

PERHAPS the best answer is that its future is not in the wholesale destruction of existing great systems. It is in the development of a field of its own, with recognized limitations but of vast possibilities. It will fill that field to the practical exclusion of all other methods of transmitting energy; it will operate all street railway systems, and elevated and underground roads; it will prove a valuable auxiliary to trunk systems; but it has not yet sounded the death-knell of the locomotive any more than the dynamo has that of the stationary steam engine. Each has its own legitimate field which will play its proper part in the needs of all civilization.

The adoption of electricity on any trunk line service will be determined by the hard and fast rule of financial necessity. It is my belief that some of the largest expenditures, and those most fruitful of return to those who own the steam railroads of the country today, will be in the purchase and control of the competing electric railways which, having in the past acquired frachises of undoubted value, have built up a business which they can hold and which will increase. Many a steam railway will be better off financially and bring bigger returns if it gathers in these franchises and systems and takes to its lines an advantage it will be difficult to duplicate in the future.—Frank J. Sprague, International Electrical Congress.

[Reprint from *American Engineer's and R. R. Journal.*]

Tests of the New York Central Locomotive.

"THE most important public electric railway tests ever made in the United States were conducted with notable success on November 12, by the New York Central and Hudson River Railroad Company, when the new high speed electric locomotive built by the General Electric Company and the American Locomotive Company, was given its first public trial. The scene of the demonstration was the special section of track laid with third rail between Schenectady and Hoffmans, and the witnesses comprised a number of the leading managers of electric and street railway systems, electrical engineers and some forty members of the technical and daily press.

"The New York Central and Hudson River Railroad Company is now electrically equipping its terminal network for a distance of 34 miles on the main line from the Grand Central Station to Croton, near Peekskill, and for 24 miles on the Harlem Division as far as White Plains. It is the intention to handle all the traffic within this district or zone electrically, and the locomotive just given trial is one of thirty to fifty which will be used in the haulage of the through passenger trains, the heaviest of which will reach 875 tons in weight and are to be hauled at a maximum speed of 60 to 65 miles per hour."

"The New York Central locomotives are not designed for abnormally high speeds at intervals, but rather to obtain a high average schedule, due to their ability to accelerate more rapidly than is possible with the present steam locomotives. In the starting tests a speed of 30 miles per hour was reached in 60 seconds with an 8-car train weighing, including the locomotive, 431 tons, corresponding to an acceleration of one-half mile per hour per second. During certain periods of the acceleration the increase in speed amounts to .6 miles per hour per second, calling for a tractive effort of approximately 27,000 pounds developed at the rim of locomotive drivers. This value was somewhat exceeded with the four-car train, where a momentary input of 4,200 amperes developed a tractive effort of 31,000 pounds at the drivers with a coefficient of traction of 22.5 per cent. of weight on drivers. The average rate of acceleration with the four-car train, weighing, including the locomotive, 265 tons, was 30 miles in 37½ seconds, or .8 mile per hour per second, calling for an average tractive effort of 22,000 pounds.

"The maximum input recorded, 4,200 amperes at 460 volts, or 1,932 k.w., gives an output of the motors of 2,200 h.p. available at the wheel. With 4,200 amp and a main-

tained potential of 600 volts there would have been an input of 2,520 k.w., corresponding to 2,870 h.p. output of the motors. This output is secured without in any way exceeding the safe commutation limit of the motors and with a coefficient of traction of only 2.25 per cent. of the weight upon the drivers, thus placing this electric locomotive in advance of any steam locomotive yet built. No service capacity temperature runs have been made as yet, and the preliminary tests have not shown any appreciable warming up of the motors sufficiently to take thermometer readings.

"Throughout both the starting and running tests the electric locomotive shows its remarkable smoothness and steadiness in running, a distinct contrast in this respect to the steam locomotive, especially should the latter be forced to perform the work here shown to be acomplished by the electric locomotive. The elimination of gear and bearing losses permits of a very high efficiency of the locomotive. Reference to the motor characteristics shows a maximum efficiency of approximately 93 per cent. this being fully 4 per cent. better than possible with motors of the geared type. This gain is especially noticeable at the high speeds, the efficiency curve remaining above 90 per cent. even at the free running speed of the locomotive alone, in contrast to the 85 per cent. or less which would be a good showing for a locomotive provided with geared motors. The simple constructions and high efficiency made possible with this design of gearless motor, together with the minimum cost of repairs attending such a construction, makes the direct current, gearless motor type of locomotive a distinct forward step in electric locomotive construction.

"Compared with existing steam practice, it is interesting to note that the heaviest "Atlantic" type locomotive of the New York Central Company weighs approximately 150 tons including the tender, of which but 47 tons are on two pairs of drivers. It will, therefore, be seen that for every pound of effective drawbar pull the steam locomotive has a weight of over 12 pounds, as compared with but 6 pounds with the electric locomotive. Therefore, in a single electric unit, over 25 per cent. greater weight is available for traction than with the largest steam passenger locomotive now in use, with 37 per cent. less dead weight and with 28 per cent. less weight on each axle. Moreover, the electric locomotive will, of course, have an entire absence of counterbalancing of driving wheels and twist from reciprocal motion, both of which in the steam locomotive are so destructive to track and roadbed."—[*Electrical World and Engineer.*

"THE Naval Observatory will make an effort to send time signals of the new year around the world. Last year the instant which marked the beginning of the new year was transmitted over 300,000 miles of telegraph and cable wires, reaching nearly every important point, even the interior of Alaska. This year it will be sent out at midnight on December 31, and at 1, 2 and 3 o'clock A.M., 75th meridian time to announce the exact instant of the beginning of the New Year to each of the great standard time belts of the United States "—[*Electrical World and Engineer.*

"THE Lewis and Clark Centennial and American Pacific Exposition and Oriental Fair, which is to be held in Portland, Ore., during the summer of 1905, will commemorate the centennial anniversary of the arrival of Captains Lewis and Clark and their band on the North American shores of the Pacific Ocean to establish title and explore what was then an unknown region.

"When the Exposition opens its gates on June 1, 1905, it will represent an expenditure of $5,000,000, part of which is to be furnished by the United States Government. The location chosen for the Exposition consists of 190 acres of land on a lake of nearly 300 acres in surface area, situated in the northwestern part of the city near one of the best residential districts. The ground is in two pieces, separated by the lake, and they will be connected by an arched bridge. On the side nearest the city there are over 130 acres of rolling ground, which reaches an elevation of over 100 feet above the level of the lake: on this portion are erected the main buildings, many of which are nearing completion.

"Across the lake is a peninsula of about 60 acres, on which the Government buildings and exhibits will be placed. This peninsula will be connected with the mainland by a bridge 2,000 feet long, which will be the Midway or Pike of the Fair, and will be called the Trail and Bridge of Nations On each side of the bridge for about 900 feet the concessions will be located, the remaining 1,100 feet being taken up with arched construction. The Midway or Trail, built over water, will present an unusual construction, and its brilliant lights, together with the great amount of illumination on the lake, will make this scene a most attractive one."—[*Engineering Record.*

WORK on the Simplon tunnel which was intended to connect Italy and Switzerland and replace the great road over the Simplon Pass, built by Napoleon in the early portion of the nineteenth century, has again been interrupted and loss of life caused by encountering another one of the hot springs which have caused trouble from the first. The engineers have met and overcome numerous obstacles during the course of construction, but the recent disasters threaten to seriously delay the work, which was soon to have been completed. The tunnel, which is to be 12.3 miles long, will be the longest in existence, and an international exposition at Milan in 1906 had been planned in commemoration of the completion of the undertaking.